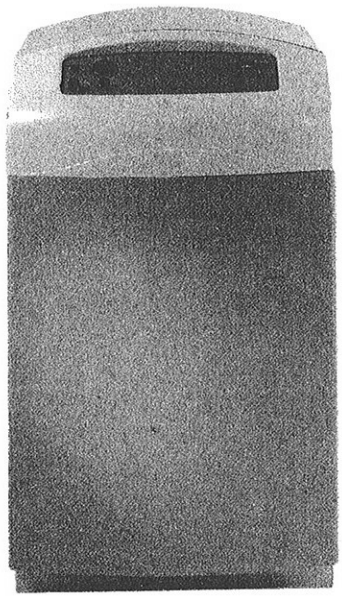
WORCESTER
Bosch Group

GREENSTAR HE OIL 12/22

ROOM SEALED BF FLOOR STANDING OIL-FIRED
CONDENSING PRESSURE JET APPLIANCE

INSTALLATION AND SERVICING INSTRUCTIONS



BOILER OUTPUT

Hot Water and Central Heating

12/22 MINIMUM 12 kW (41,000 Btu/h)
MAXIMUM 22 kW (75,000 Btu/h)

THESE INSTRUCTIONS APPLY TO UK MODELS ONLY

THESE INSTRUCTIONS ARE TO BE LEFT WITH THE APPLIANCE

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1. Installation Regulations

1.1 The appliance should be installed by a competent person. The person installing the appliance should be aware of the Health and Safety at Work Act and take appropriate action to ensure that the regulations are adhered to. In order to give optimum efficiency and trouble free operation the appliance should be commissioned by a qualified engineer.

1.2 The manufacturers notes must not be taken, in any way, as overriding statutory obligations.

1.3 The compliance with a British Standard does not, of itself, confer immunity from legal obligations. In particular the installation of this appliance must be in accordance with the relevant requirements of the following British Standards and regulations in respect of the safe installation of equipment.

BS 5410: part 1: 1997 Code of practice for Oil Fired Boilers.

BS 799: part 5: 1987 Specification for Oil Storage Tanks.

BS 7593: 1992 Code of Practice for treatment of water in domestic hot water central heating systems.

BS 5449: part 1: 1990 Code of practice for forced circulation hot water Central Heating for Domestic Premises.

BS 7074: part 1: 1989 Application, selection and installation of expansion vessels and ancillary equipment for sealed water systems.

BS 7671: IEE Wiring Regulations, current edition.

The Building Regulations Part J England and Wales; Part F Section III Scotland; Part L Northern Ireland.

Local water company bye-laws.

The Control of Pollution (Oil) Regulations.

1.4 To ensure that the installation will perform to the highest standards, the system and components should conform to those mentioned in the instructions.

2. General Information

2.1 These instructions cover room sealed balanced flue (RS) appliances only.

2.2 The Worcester Greenstar HE Oil appliance covered in these instructions has been designed to serve domestic central heating and hot water requirements ranging from 12 kW to 22 kW.

2.3 This RS balanced flue appliance forms a fully room sealed system causing the combustion air to be drawn through a duct from outside. The sealed burner cover gives excellent acoustic noise reduction and alleviates the need for an air brick to be located in the boiler room.

Because the balanced flue system does not rely on the cabinet panels to form the room seal, combustion readings can be taken from the test point on the condenser heat exchanger and the cabinet panels can be easily removed during installation thereby preventing any damage.

2.4 The boiler is factory set to the mid-range output and can be altered, if necessary, by adjusting the burner as specified in Table 2. This appliance is only suitable for use with 28 second Kerosene heating oil.

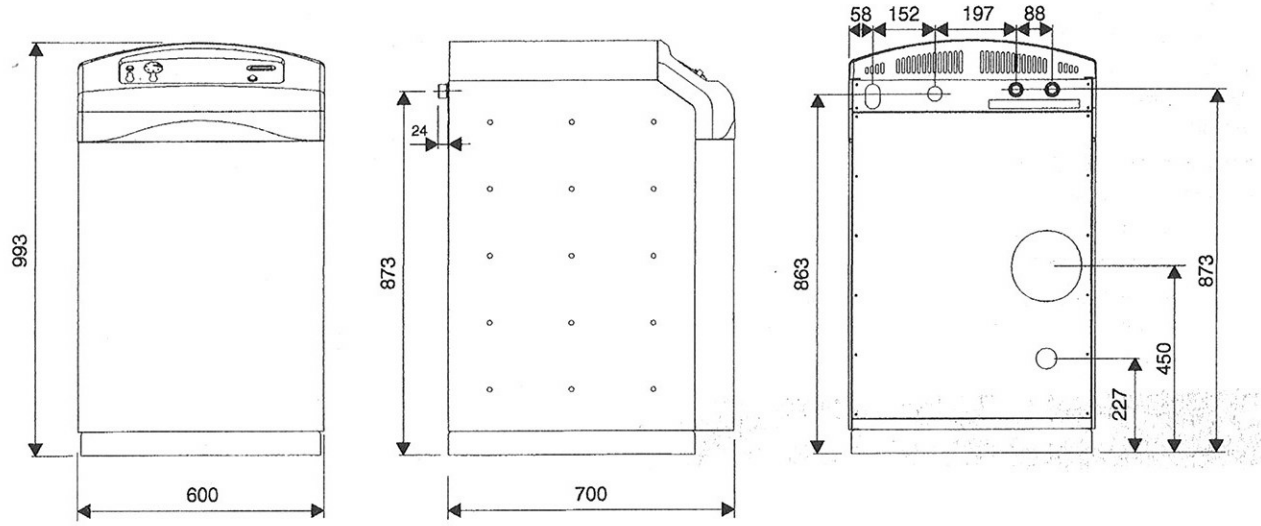
NOTE: It is a mandatory requirement of the building regulations that only 28 second kerosene is used on low level discharge flues.

3. Technical Data

Table 1

SPECIFICATIONS	
Model	**12/22**
POWER SUPPLY	230/240V 50 Hz
HEATING FLOW	22mm
HEATING RETURN	22mm
FUEL LINE	¼" BSP
MINIMUM FLUE REQUIREMENT	Balanced Flue Kit Page 8
HEARTH TEMPERATURE	Below 100°C
MAXIMUM STATIC HEAD	30m (98 ft.)
PRIMARY WATER CAPACITY	20 litres (4.4 gal.)
WEIGHT	121 Kg (267 lbs)
BURNER	Electro Oil Sterling 40
EXIT FLUE GAS MASS FLOW	40 kg/hr
CONTROL THERMOSTAT RANGE	50°C minimum cut in to 80°C maximum cut out
CONTROL THERMOSTAT DIFFERENTIAL	5°C
COMBUSTION PRODUCTS SAFETY THERMOSTAT BREAK POINT	120 + 0/ – 6°C

Fig. 1. Principal Dimensions (All Dimensions are millimetres)



12/22 Table 2. Electro Oil Bentone Sterling 40 Burner (See Fig. 25) **RS Balanced Flue Appliance**

NOMINAL BOILER RATING AT NORMAL OPERATING TEMPERATURE											
Fuel	Nozzle	Pump Pressure (p.s.i.)	Fuel Flow Rate		Flue Gas Temp. °C	$\%CO_2$	Approx. Air Setting	Appliance			
								Input		Output	
			Kg/h	l/h				kW	Btu/hr	kW	Btu/hr
28 Sec. Kerosene	0.40 80°EH	150	1.24	1.55	60	10.5-11.0	2	14.7	50,000	14.1	48,000
28 Sec. Kerosene	0.45 80°EH	150	1.46	1.83	70	11.0-11.5	3	17.3	59,000	16.6	57,000
28 Sec. Kerosene	0.50 80°EH	150	1.68	2.10	80	11.5-12.0	5	22.0	75,000	21.1	72,000

Note: These figures are given for guidance only, it is essential therefore that the settings are adjusted to give the correct CO_2 value.

4. Siting the Appliance

4.1 The appliance is not suitable for external installation unless a suitable enclosure is provided.

4.2 The appliance should be positioned on a non-combustible solid base as near to the flue termination point as possible. Care should be taken to ensure that the appliance is level; use packing at the corners where necessary.

4.3 The rear of the appliance must be positioned so that the flue terminal can safely discharge the flue gases as described in Section 7.

4.4 The following clearances must be left to allow access for installation and servicing:

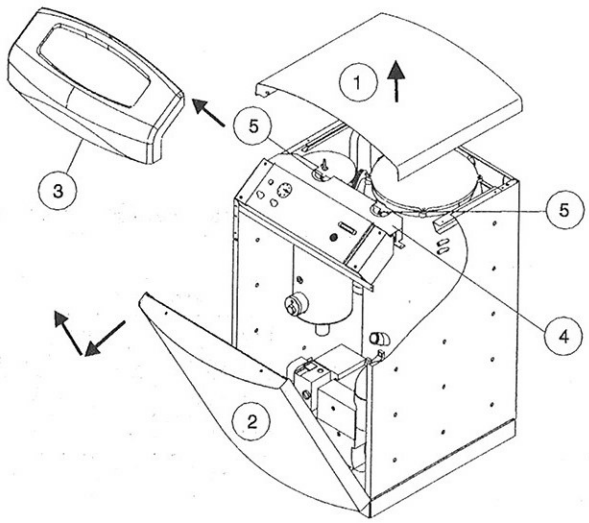
(a) Above 600mm

(b) In front - 600mm

(c) Right and left hand side – sufficient for panel removal and access to pipe connections where required.

5. Removal of the Cabinet

Fig. 2



1. Cabinet top panel
2. Front panel
3. Plastic facia surround
4. Electrical cover plate
5. Electrical cover plate securing screws

For installation and servicing of the appliance the cabinet should be removed as follows: (See Fig. 2.)

5.1 Remove the cabinet top panel (1) by lifting squarely upwards to release the four stud connections.

5.2 Remove the front panel (2) by pulling the upper part of the panel forwards to release the studs and lifting the panel upwards to release it from its supporting ledge.

5.3 Remove the plastic facia surround (3) by liffting up and forward to release the four ball studs.

5.4 Remove electrical cover plate (4) by unscrewing the two screws (5) at the rear of the connector protecter plate and hinge up and away.

6. Air Supply

6.1 The appliance does not require a separate vent for combustion air.

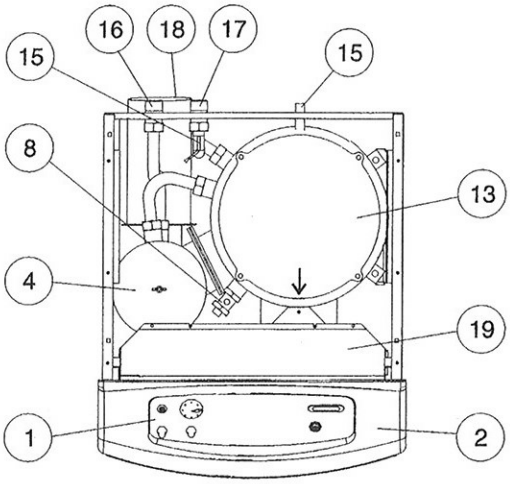
6.2 Installation in cupboards or compartments requires permanent vents for cooling purposes, one at high level and one at low level, either direct to outside air or to a room. Both vents must pass to the same room or be on the same wall to the outside air. The minimum air vent free area is given in Table 3.

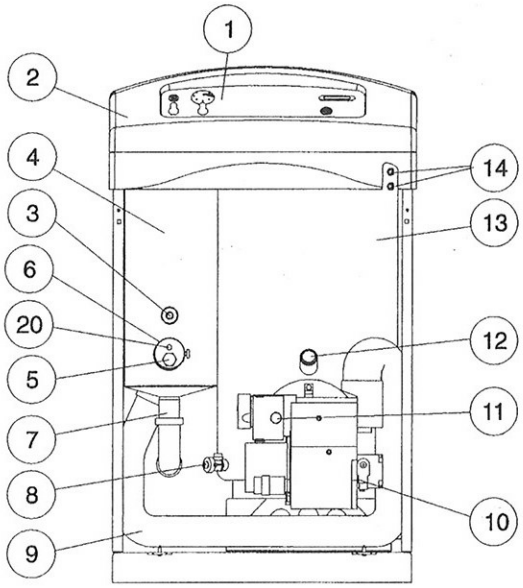
6.3 There must be sufficient clearance around the appliance to allow proper circulation of ventilation air. The clearances required for Installation and Servicing will normally be adequate for ventilation. See Section 4.4.

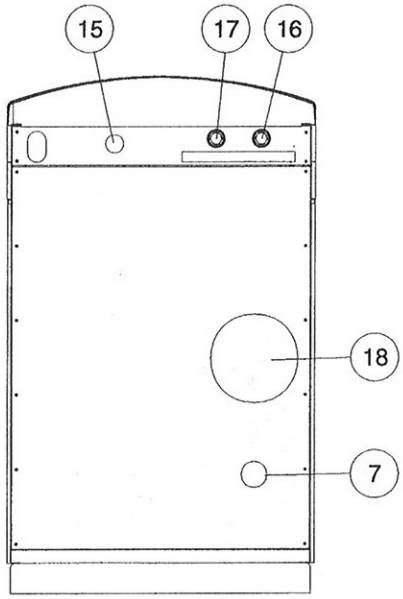
Table 3. Minimum Air Vent Free Area for Room Sealed appliances installed in a compartment.

Appliance model	Ventilation to room or internal space		Ventilation to outside	
	High Level	Low Level	High Level	Low Level
12/22	242cm²	242cm²	121cm²	121cm²

Fig. 3. Components

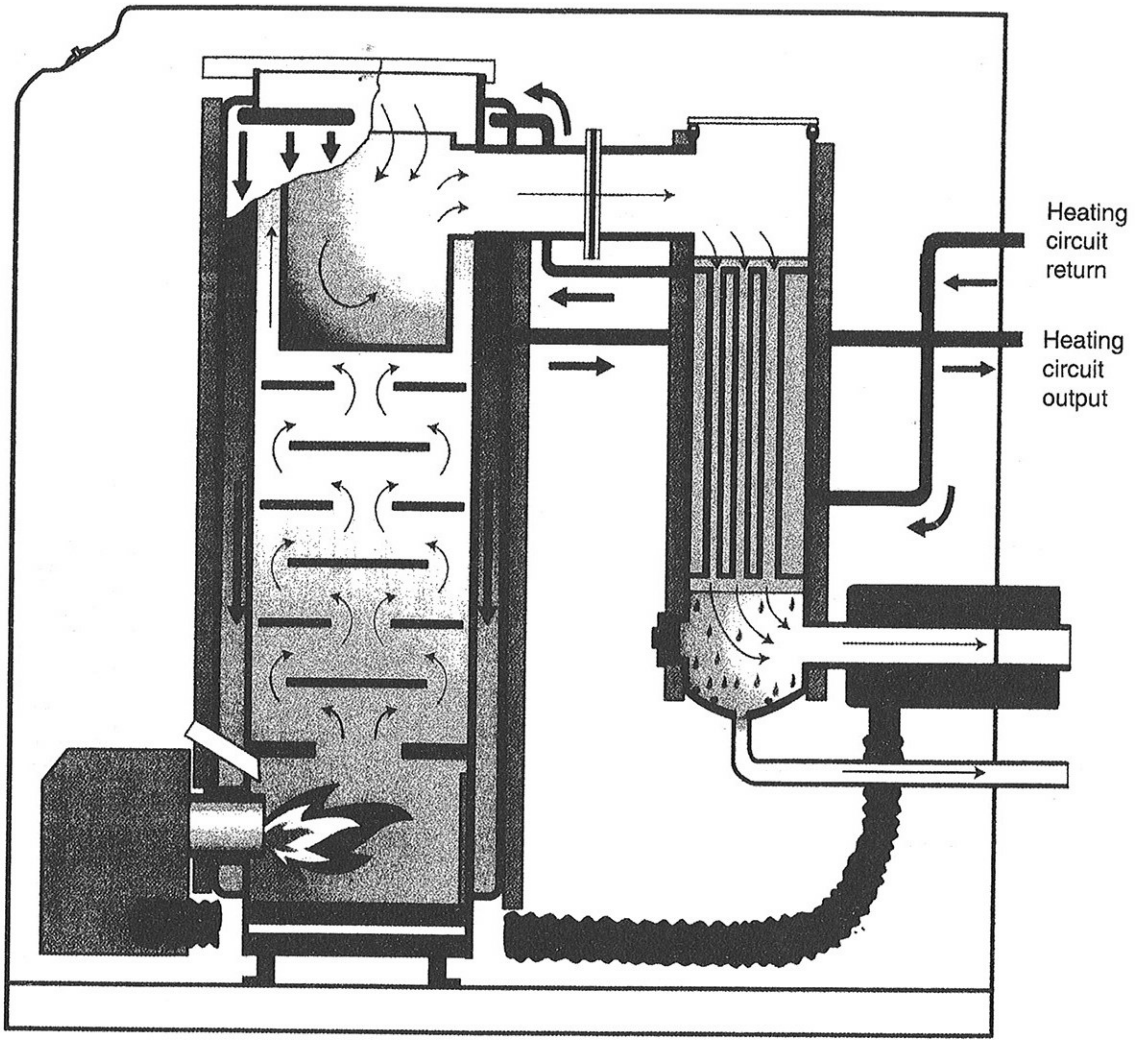






1) Control panel
2) Plastic cover
3) Condenser drain point
4) Secondary heat exchanger
5) Combustion product test point
6) Secondary heat exchanger inspection/cleaning port
7) Condensate drain
8) Heat exchanger drain point
9) Burner air inlet pipe
10) Oil Burner
11) Lock out reset button
12) Sight glass
13) Boiler shell
14) Pockets for water high limit safety and thermostat bulbs
15) Auto air vent connection
16) Heating flow
17) Heating return
18) Combustion products flue exit
19) Electrical cover plate

Fig. 4. Principle of Operation



The Greenstar HE Oil 12/22 is a sealed exhaust circuit condensation boiler.

Air is drawn in by the burner's fan from outside the appliance through the hose connected to the air inlet and combustion product evacuation concentric tube.

The boiler shell equipped with a system of removable baffles, is linked to a stainless steel secondary heat exchanger located directly on the heating return.

7. Flue System

A flue system provided by Worcester Bosch, must be fitted in accordance with BS5410:Part 1 and the Building Regulations.

The appliance is supplied ready for installation to a balanced flue system by the simple addition of one of the flue terminal kit options shown in Figs. 5 to 14.

Details of the installation procedure are included in the Flue Terminal Instructions supplied with the terminal kit.

7.1 Siting the flue terminal

1. The flue terminal must be located in a suitable position, as shown in Fig.15, such that the products of combustion can be freely dispersed without the possibility of the gases entering the dwelling or that of a neighbouring dwelling.

2. Discharge of flue gases into car ports or narrow passageways is not recommended.

3. The terminal must not cause an obstruction nor the discharge cause a nuisance as a result of either flue gases or terminal noise.

4. If a terminal is fitted less than 2 metres above a surface to which people have access, a suitable terminal guard must be fitted.

A suitable guard is available from Worcester Heat Systems, Part Number 7 716 190 009, or alternatively a proprietary terminal guard may be used provided it leaves 75mm clearance all around the terminal.

The guard should have suitable corrosion resistance due to the acidic content of the flue gases.

5. The terminal guard must be evenly spaced about the flue terminal and secured using screws so that the terminal guard can be removed for maintenance to the flue terminal..

6. In certain weather conditions. The terminal may steam and siting where this could cause a nuisance should be avoided.

7. Take care to ensure that combustion products do not enter ventilated roof voids.

Fig. 5. Standard Horizontal Flue

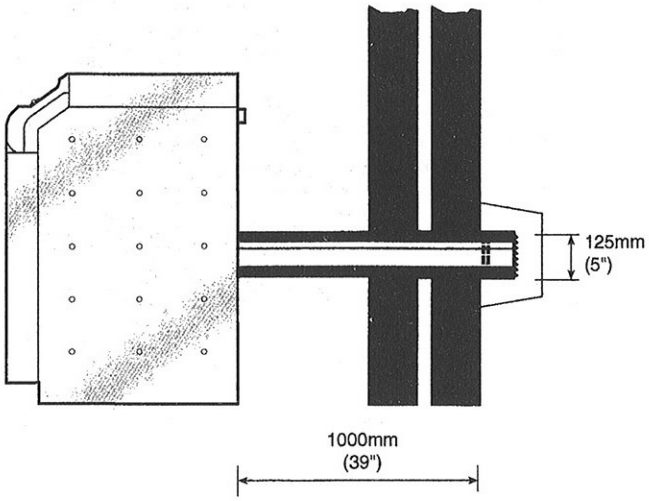


Fig. 6. Extended Horizontal Flue

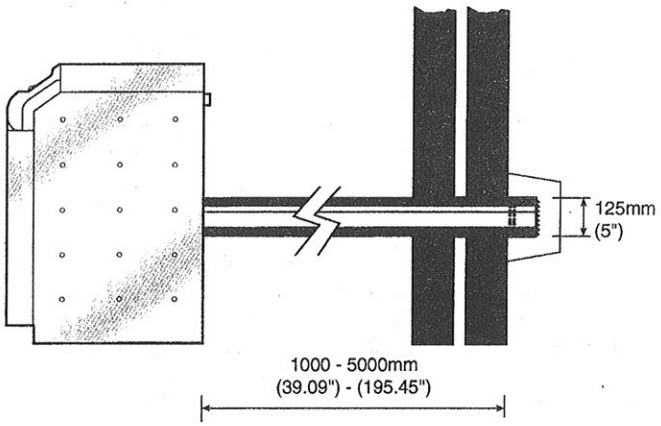


Fig. 7. Horizontal Flue with one 90° Bend

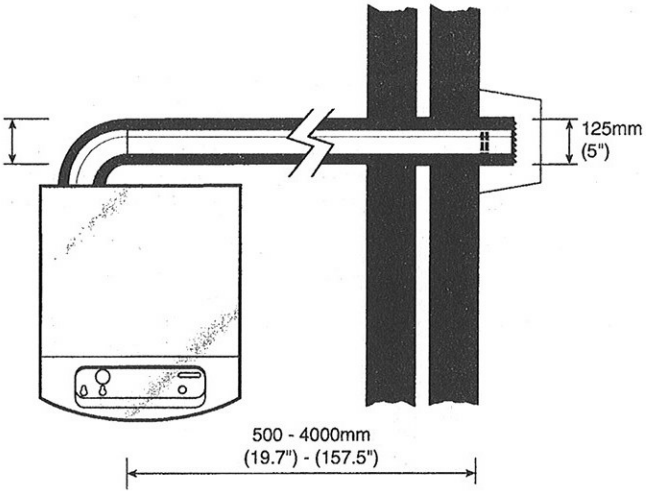


Fig. 8. Horizontal Flue with two 90° Bends

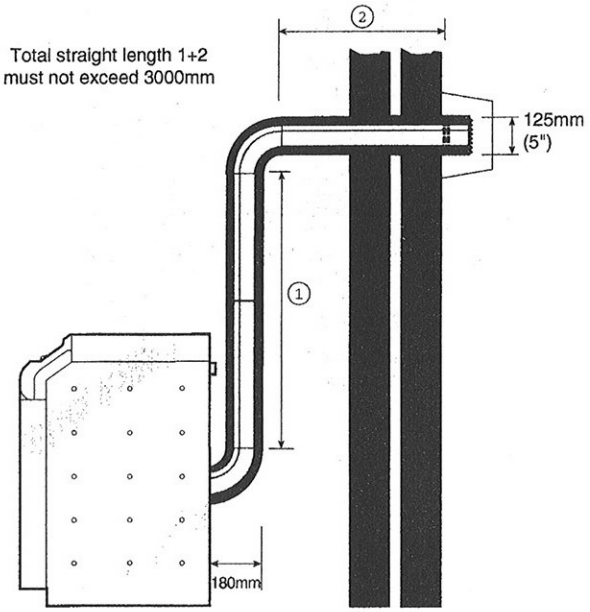


Fig. 9. Flue with one 90° and two 45° Bends

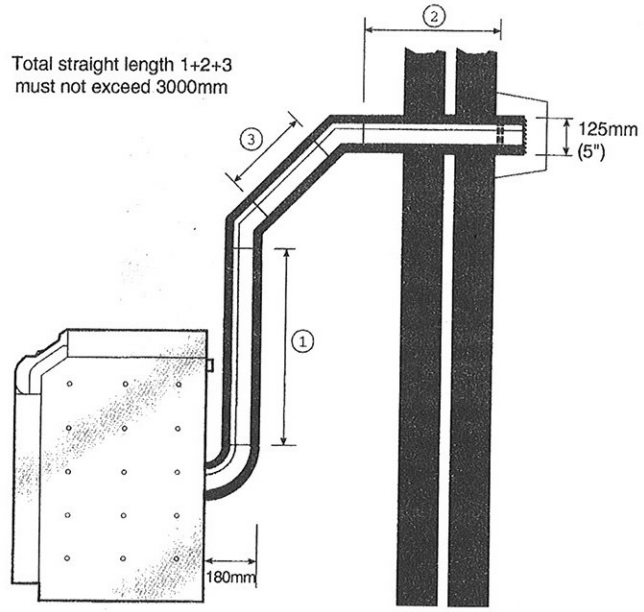


Fig. 10. Flue with two 90° Bends

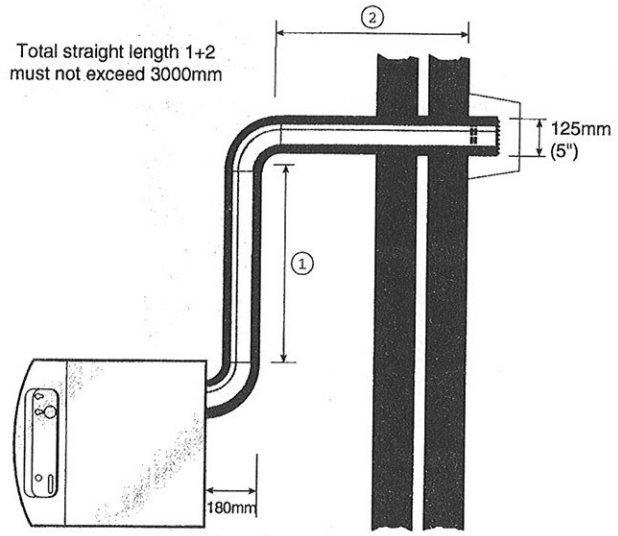


Fig. 11. Flue with one 90° and two 45° Bends

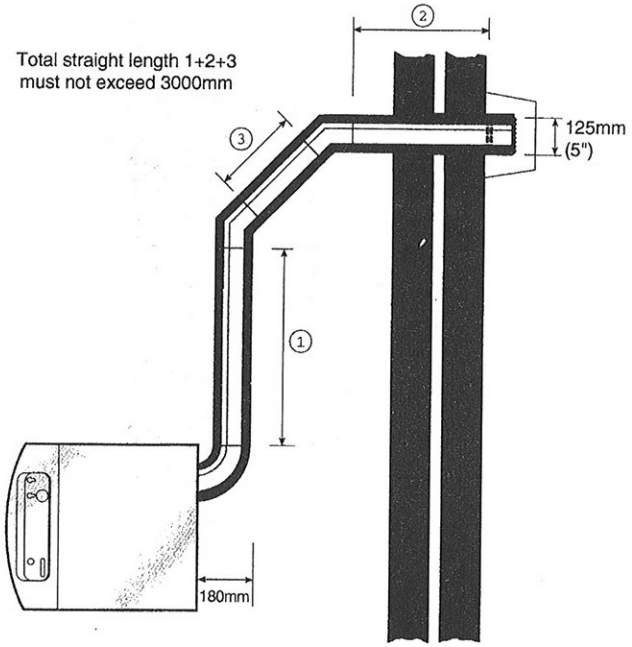


Fig. 12. Vertical Flue

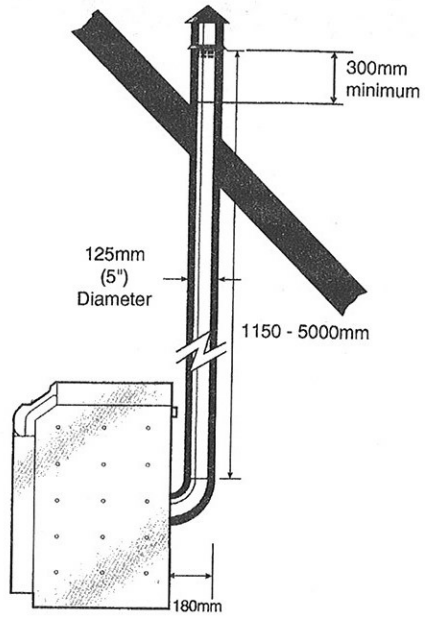


Fig. 13. Vertical Flue with two extra 90° Bends

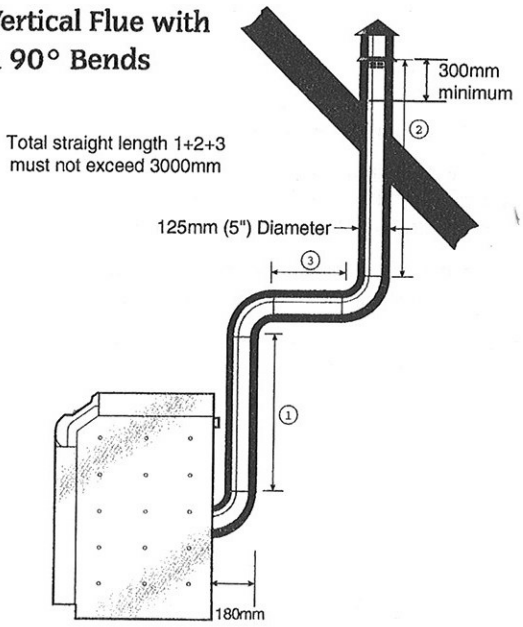


Fig. 14. Vertical Flue with two extra 45° Bends

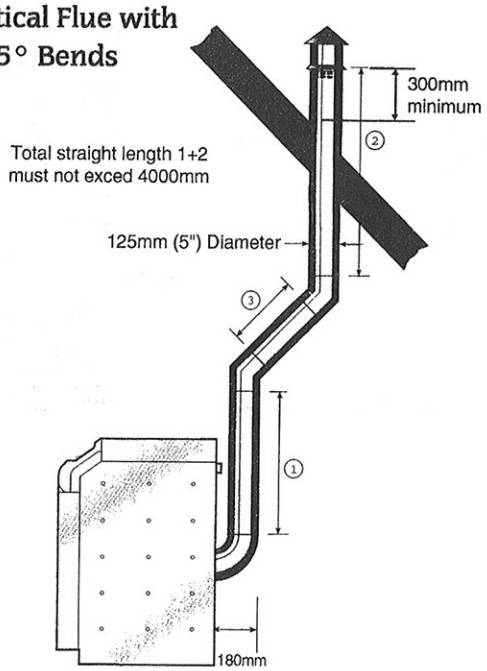
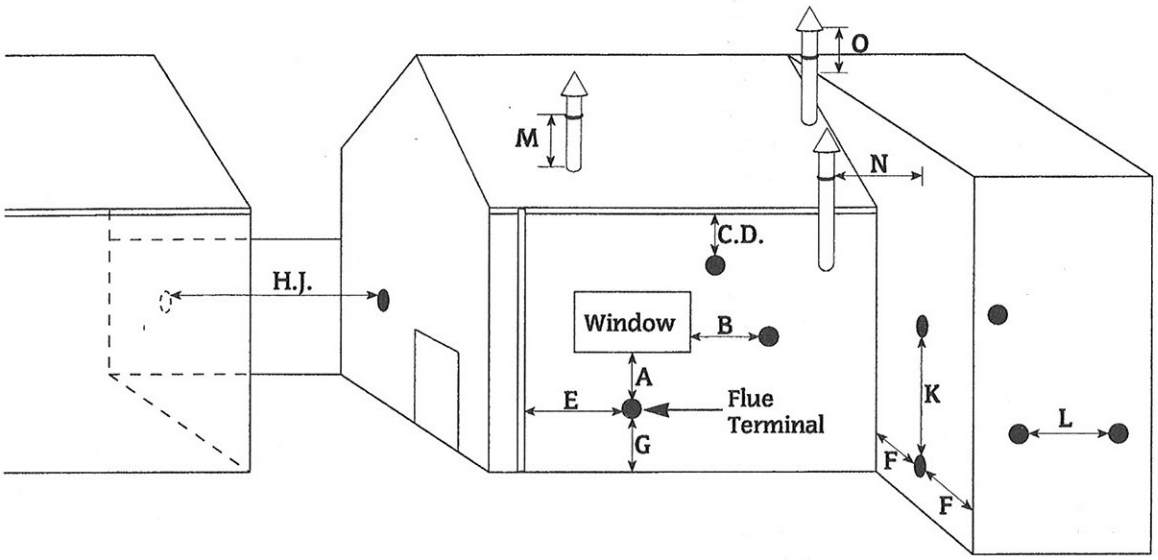


Fig. 15. Flue terminating positions for oil-fired appliances

NOTE: The dimensions given are for general guidance only. Other surrounding buildings or objects may affect the clearance of combustion products. An alternative flue terminal position should be sought when there is any possibility of a nuisance being caused by inadequate dispersal of flue products.
Terminals should be positioned so as to avoid products of combustion entering into buildings.



Terminal Position		Minimum Distance (mm)
A	Directly below an opening, air brick, window, etc.	600
B	Horizontally to an opening, air brick, window, etc.	600
C	Below a gutter or sanitary pipe	75
D	Below eaves or a balcony	600
E	From vertical sanitary pipework	75
F	From an internal or external corner	300
G	Above ground or balcony level	300
H	From a surface facing the terminal	600
J	From a terminal facing the terminal	1200
K	Vertically from a terminal on the same wall	1500
L	Horizontally from a terminal on the same wall	300
M	Above intersection with roof	300
N	From a vertical structure on the side of the terminal	600
O	Above a vertical structure on the side of the terminal	600

8. Oil Supply

8.1 The oil storage tank must be installed in accordance with BS799 Part 5. A steel tank should be arranged with a slope of 1 in 24 away from the outlet valve with a sludge cock at its lower end. A plastc tank should be sited on a firm, level fireproof base. The base should extend out 300mm from all sides of the tank. There is generally no need for the tank to be installed on an angle away from the outlet valve.

8.2 Do not use galvanised steel tanks or pipework for the oil supply system.

8.3 Do not use soldered joints on the oil supply pipework as this could cause a hazard in the case of a fire.

8.4 The burners on all appliances are supplied so as to be connected to a single pipe gravity feed system. Details of how to convert the burner to a double-pipe sub-gravity feed system are shown in Fig. 16.

8.5 If a single pipe system is employed then the tank must be positioned such that the oil level does not exceed 4 metres above the level of the burner oil pump and in addition the oil level must be at least 0.3 metres above the level of the oil pump. Should it prove impossible to site the tank below the 4 metres maximum oil level a head breaking device must be installed between the tank and the burner.

8.6 If a double pipe system is used then the maximum suction height allowable is 3.5 metres.

8.7 The oil supply pipe diameter can be determined using Tables 13 and 14 depending on whether a single or double pipe system is being installed. Selection of the correct pipe diameter will depend on the position of the oil storage tank relative to the burner and the length of the pipe run.

8.8 The oil supply pipe should be laid as level as possible to avoid air pockets and unnecessary friction losses.

8.9 The following components should be fitted in the fuel line between the storage tank and burner:

1. A manual isolating valve installed as close to the tank as possible.

2. A fire valve in accordance with BS799: Part 2 as shown in Fig. 17. The fire valve should be fitted externally with a fire detection element located within the appliance case. Use of a capillary type valve will allow a neat and simple installation. A suitable valve is the KBB manufactured by Teddington Controls Limited. Alternatively a fusible link or electrical system may be used. Under no circumstances should a combination isolating/fire valve be used as the sole fire protection device.

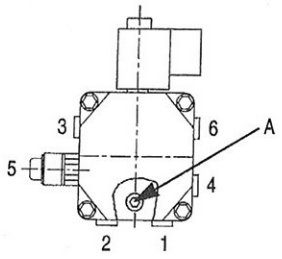
3. A paper element filter complying with the requirements of BS799, Parts 2, 3 and 4 should be fitted in the fuel line between the fire valve and the isolating valve but not within the appliance casing.

TABLE 4 Single Pipe Gravity Feed System

HEAD (metres)	MAXIMUM ALLOWABLE PIPE RUN (metres)	
	8 mm inside dia. pipe (10 mm O.D. copper)	10 mm inside dia. pipe (12 mm O.D. copper)
0.5	10	20
1.0	20	40
1.5	40	80
2.0	60	100

Fig. 16. Oil Pump.

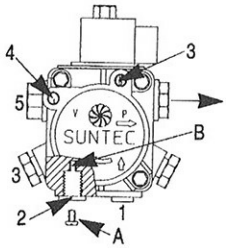
A. Danfoss BFP 11 Oil Pump.



1. Inlet
2. Return
3. Bleed and pressure gauge port
4. Vacuum gauge port
5. Pressure adjustment
6. Nozzle outlet

To convert to a double pipe system: Remove the pump front cover, remove the changeover screw (A) nearest to ports 1 and 2, and the horseshoe washer underneath. Replace the changeover screw back into the threaded hole. Connect the flow and return pipes to 1 and 2.
Note: When removing the pump front cover ensure that a suitable receptacle is placed below the pump to catch the oil residue.

B. Suntec AS47C Oil Pump.



To convert to a double pipe system, remove the return port plug (2) and insert the grub screw (A) provided into the threaded hole (B). Connect flow and return pipes to (1) and (2).

TABLE 5 Double Pipe Sub-Gravity Feed System

HEAD (metres)	MAXIMUM ALLOWABLE PIPE RUN (metres)	
	8 mm inside dia. pipe (10 mm O.D. copper)	10 mm inside dia. pipe (12 mm O.D. copper)
0	35	100
0.5	30	100
1.0	25	100
1.5	20	85
2.0	15	70
2.5	11	50
3.0	8	30
3.5	6	20

Fig. 17. Oil Supply.

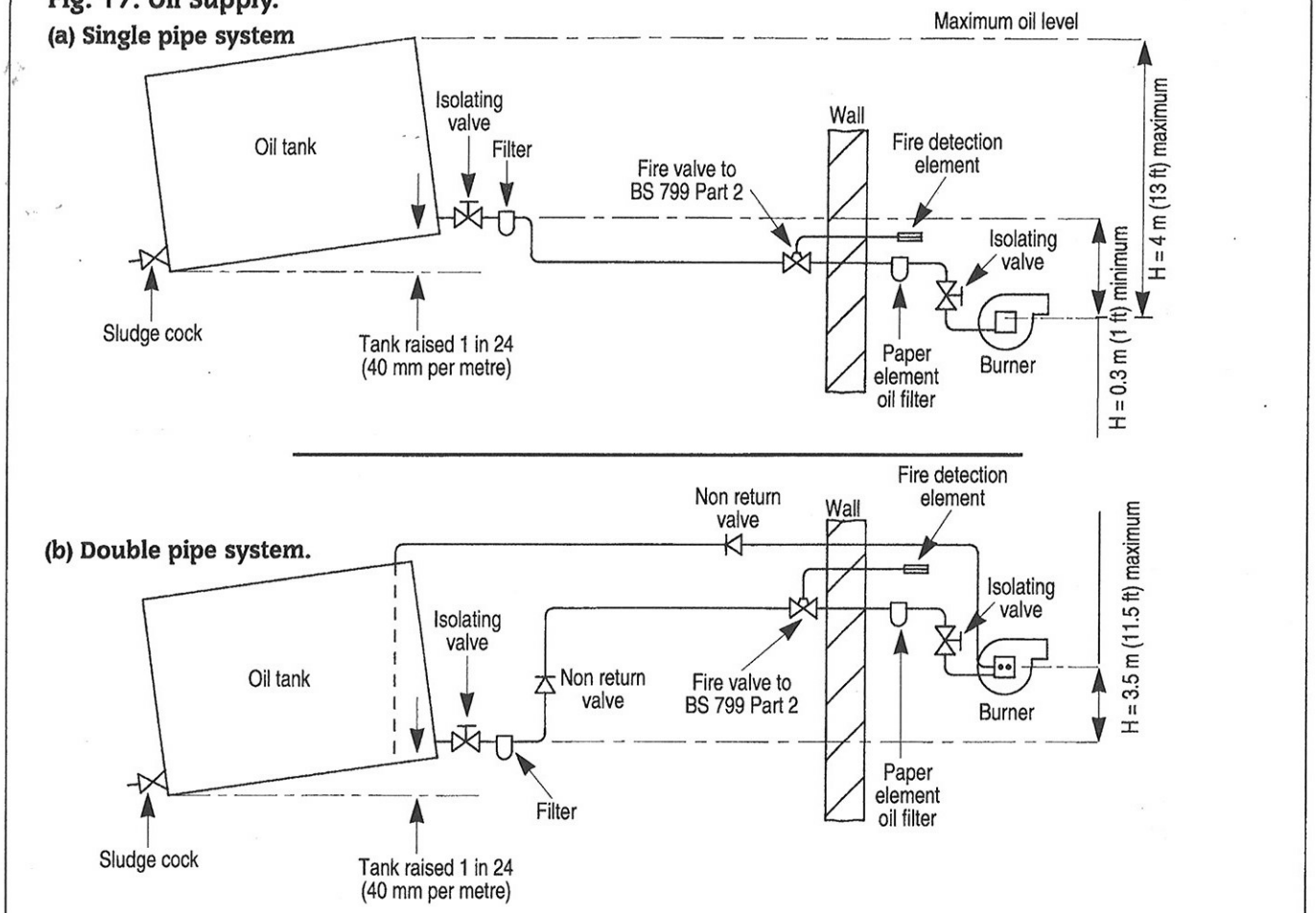


Fig. 18. Typical fully pumped open vent system (Honeywell 'Y' plan).

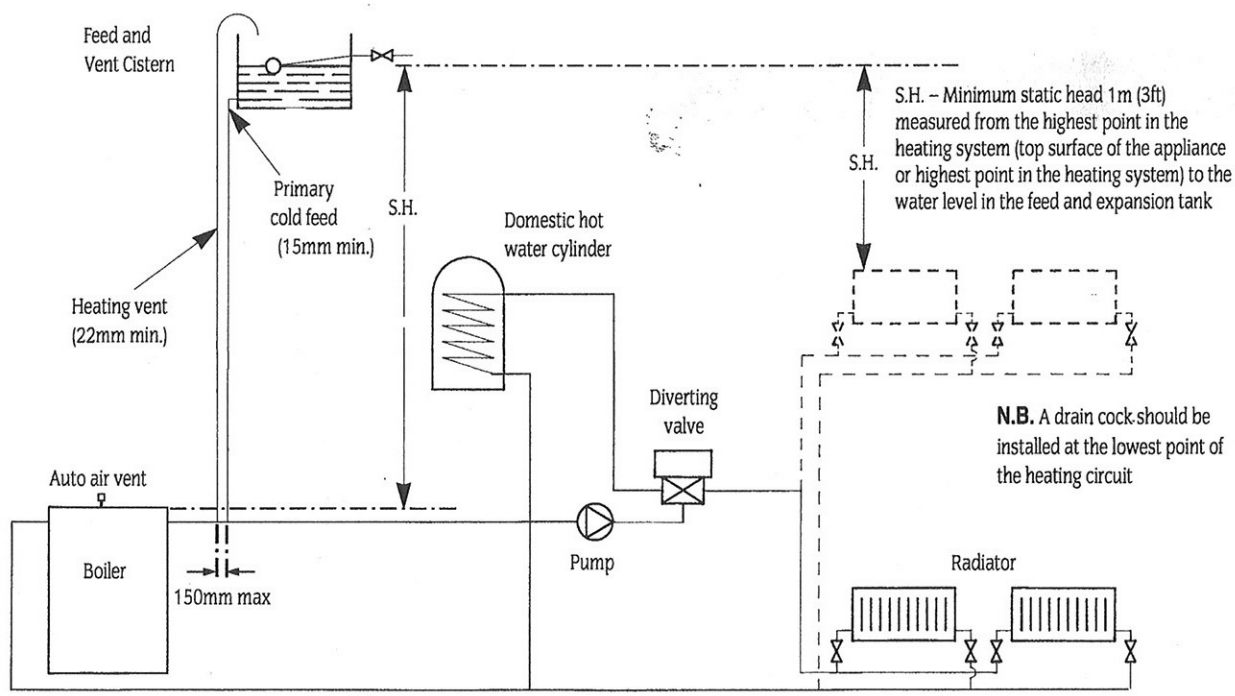

Feed and Vent Cistern
Primary cold feed (15mm min.)
S.H.
Domestic hot water cylinder
S.H.
S.H. – Minimum static head 1m (3ft) measured from the highest point in the heating system (top surface of the appliance or highest point in the heating system) to the water level in the feed and expansion tank
Heating vent (22mm min.)
Diverting valve
N.B. A drain cock should be installed at the lowest point of the heating circuit
Auto air vent
Boiler
150mm max
Pump
Radiator

Fig. 19. Typical fully pumped sealed system (Honeywell 'Y' plan).

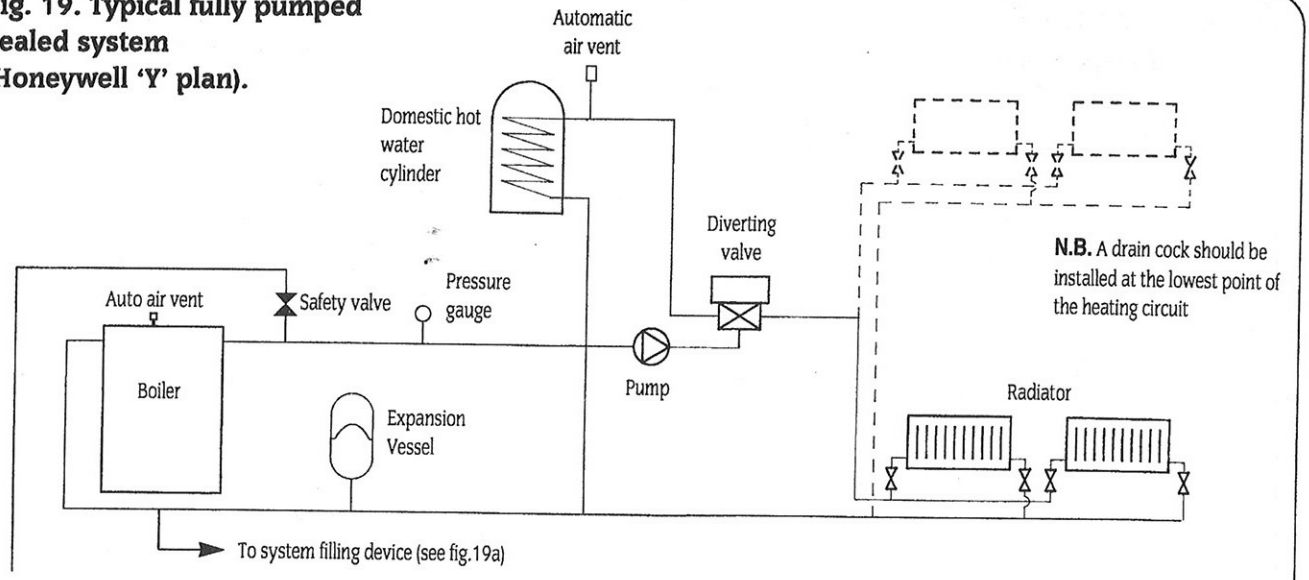
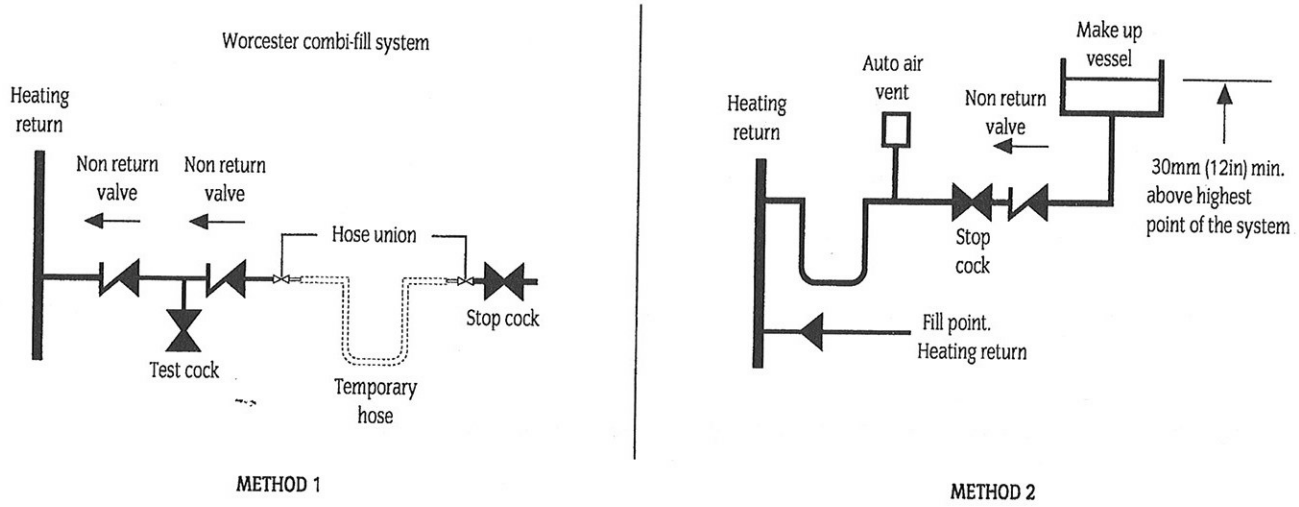


Fig. 19a. System filling and make-up



9. Heating and Hot Water System

9.1 The appliance is suitable for connection to all conventional indirect hot water systems utilising an indirect double feed cylinder.

9.2 The flow and return connections are located at the rear of the appliance.

9.3 There is no requirement for a system bypass.

9.4 The pressure jet burner fitted to the appliance has full automatic control and hence there is no requirement for heat leak radiators.

9.5 The primary system should be flushed and treated in accordance with the recommendations of BS 7593:1992 before the system is handed over to the user.

9.6 The pump should be set in accordance with the heating load requirements to give a flow and return differential temperature of 11°C under full load conditions.

Open Vent Primary System.

(See Figs. 18 and 19).

The following points are for guidance only. The system connection point should be carried out in accordance with BS 5449: Part 1.

1. Feed and Expansion System

The feed and expansion pipes must rise continuously from the appliance and must be of the minimum diameter shown in Figs 18 and 19.

The cistern must be arranged to provide a minimum static head of 1 metre above the top of the highest point in the heating circuit.

2. Filling and Venting

Air in the appliance is expelled through the vent pipe or dissipated into the system. Manual air vents should be fitted at any high points in the system.

There is a connection on the appliance for connecting an auto air vent.

Sealed Primary System

The appliance is supplied with a manual reset thermostat and is suitable for use with a sealed primary system.

General

The system should be installed in compliance with the requirements of BS5449: Part 1. The boiler must be fitted with a spring loaded safety valve set to operate at 3 bar (45 psi) and the pipe connections made throughout the system must be capable of sustaining a pressure of up to 3 bar.

The following is a list of major items which must be fitted to the system:

1. Safety valve – 3 bar
2. Pressure gauge – 0 to 4 bar.
3. Expansion vessel
4. Automatic air vent.

10. Electrical

(See Figs. 20 to 22).

10.1 The wiring between the appliance and the electrical supply shall comply with current IEE Wiring Regulations and any local regulations which apply.

10.2 To gain access to the electrical terminal strip.

1. Isolate the mains electrical supply.
2. Remove the cabinet top panel by pulling squarely upwards.
3. Release the two screws securing the terminal connector protector plate and remove.

10.3 Mains Wiring

Mains supply – 230/240 V AC ~ 50 Hz 5A External Fuse.

LIVE - Brown, NEUTRAL - Blue, EARTH - Green/Yellow

Mains Cable: 0.75mm^2 (24 x 0.20 mm) to BS 6500 Table 16.

The method of connection to the appliance must allow complete isolation of the appliance, preferably via a double pole isolator with a contact separation of 3 mm in all poles supplying the boiler and controls only.

The mains supply cable should be connected into the terminals marked **L** (Live), **N** (Neutral) and **E** (Earth) on the appliance terminal strip and securely held in the cable clamp located on the right-hand side of the electrical box.

The appliance must be earthed.

If an external programmer is fitted to the boiler, the link across terminals 1 and 2 of the terminal strip should be removed (see Fig. 21).

Connect the programmer permanent live to terminal 1, switched live to terminal 2 and neutral to terminal N.

NOTE: Under no circumstances should the timer be connected to a separate electrical supply. Safety is assured from a single fused supply to the boiler.

The timer must be suitable for use with mains voltage.

10.5 Safety Check

In the event of an electrical fault after the installation of the appliance, the electrical system shall be checked for short circuits, fuse failure or incorrect polarity of connections.

10.6 Honeywell "S" Plan

The "S" plan provides complete control on installations having pumped circulation to both the domestic hot water and radiator circuits.

The domestic hot water and radiator circuits are independently controlled by two motorised valves via a cylinder thermostat and a room thermostat. Both thermostats switch the water circulator and the boiler on and off.

10.7 Honeywell "Y" Plan

(See Fig. 18 and 19).

The "Y" Plan provides complete control on installations having pumped circulation to both the domestic hot water cylinder and radiator circuits.

The domestic hot water and radiator circuits are controlled by a 3 port motorised valve via a cylinder thermostat and a room thermostat. Water flow is diverted to either circuit or to both circuits at the same time. Both thermostats switch the water circulator and the boiler on and off.

Note: The "Y" plan requires a live feed from the hot water "off" switch position.

10.8 Programmer

(See Fig. 21).

An external programmer can be fitted to the system.

10.9 Frost Protection

For full frost protection a single pole switch thermostat can be fitted across terminal 1 and 2 (see Fig. 21) regardless of any other device using these terminals.

NOTE: For the frost thermostat to be effective, the boiler control thermostat must be set to **ON.**

11. Installation

11.1 After unpacking the appliance it is recommended that the top and front cabinet panels are removed, as described in Section 5, and stored in a safe place to avoid damage during installation and allow easy inspection for any leaks after the system has been filled.

11.2 Remove the burner as described below and store in a safe place until the appliance is ready for commissioning.

1. Remove the air tube from the burner by loosening the jubilee clip and pulling the tube up and away.

2. Remove the 13mm nut at the top of the burner and pull the burner out, taking care not to put any tension on the electrical cable.

11.3 Flue system installation.

Install the appliance flue system as described in Section 7.

11.4 Heating system installation.

1. Plumb the boiler into the central heating system.

2. Fit the auto air vent.

3. Fill the system and vent all radiators and high points to remove air from the system.

4. Check the boiler and all pipework connections for leaks.

5. The primary system should be flushed in accordance with the recommendations of BS 7593:1992.

11.5 Oil supply installation.

(See Section 8 and Fig. 17).

Note: Never route the oil supply pipe/hose directly below the combustion chamber base.

Never use soldered joints on oil supply pipes as this could cause a hazard in the case of a fire.

(a) Double pipe system oil return pipe.

1. fit the oil return pipe, from the tank, down the left hand side of the boiler along the base. Terminate the end approximately 200mm from the front of the base.

2. Connect a flexible hose, of the same type as the one supplied, to the pipe using a suitable adaptor.

Ensure that the connections are properly sealed.

3. Fit the oil supply pipe as described in the following section.

(b) Single pipe system oil supply pipe.

1. Fit the oil supply pipe, from the tank, down the left hand side of the boiler along the base. Terminate the end approximately 200mm from the front of the base.

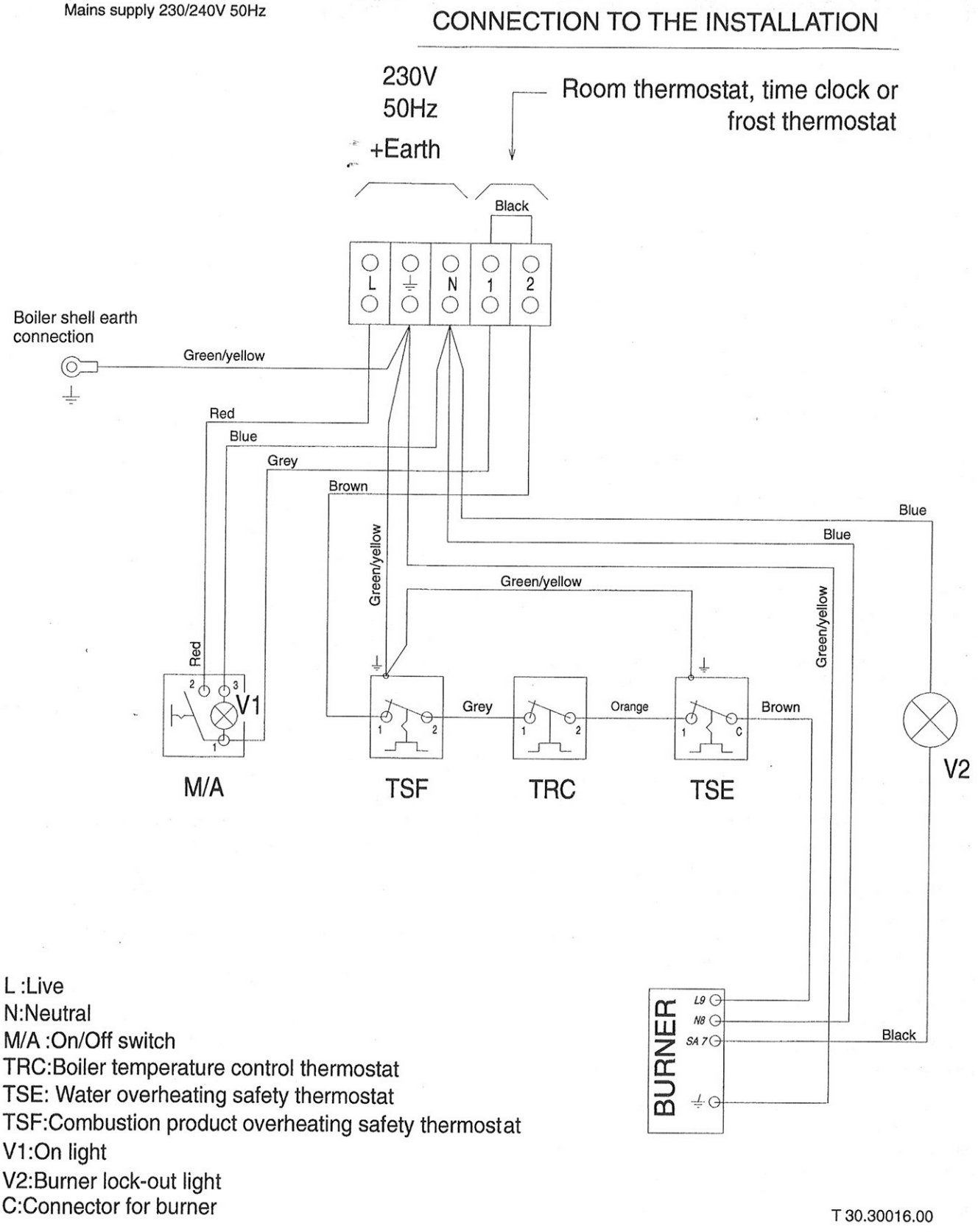
2. Open the main oil supply valve at the tank and check for any leaks.

3. Draw off at least 2.5 litres of oil until a steady flow of clear uncontaminated oil can be seen and turn off the isolating valve.

NOTE: This method may not be possible on some installations where a sub-gravity system is used. Where this problem arises-bleed the system using the oil pump as described in Section 12 and remove and clean the oil pump filter to remove any debris collected as a result of installation.

Fig. 20. Wiring Diagram (Standard).

Mains supply 230/240V 50Hz



L :Live
N:Neutral
M/A :On/Off switch
TRC:Boiler temperature control thermostat
TSE: Water overheating safety thermostat
TSF:Combustion product overheating safety thermostat
V1:On light
V2:Burner lock-out light
C:Connector for burner

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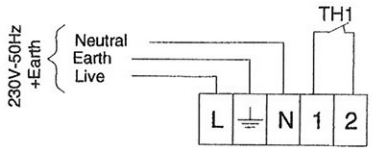
Fig. 21. Room thermostat, time clock or frost thermostat connections.



TH1 = Room thermostat, clock or frost thermostat

No control

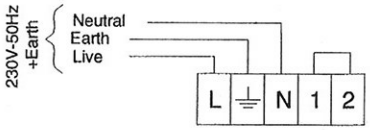
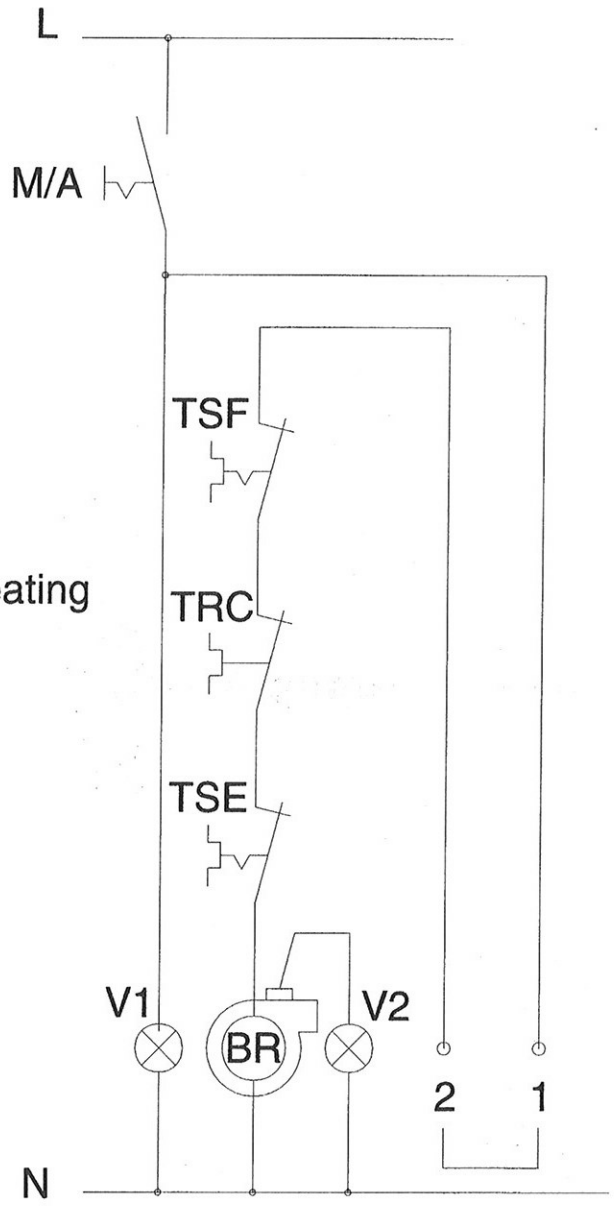


Fig. 22. Principle schematic

L	Live
N	Neutral
BR	Burner
M/A	On/off switch
TRC	Boiler temperature control thermostat
TSE	Water overheating safety thermostat
TSF	Combustion product overheating safety thermostat
V1	Burner lock-out light
V2	On light



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1	Timer controls
2	Extermal thermostat controls

11.6 Condense drain connection (see Fig. 23)

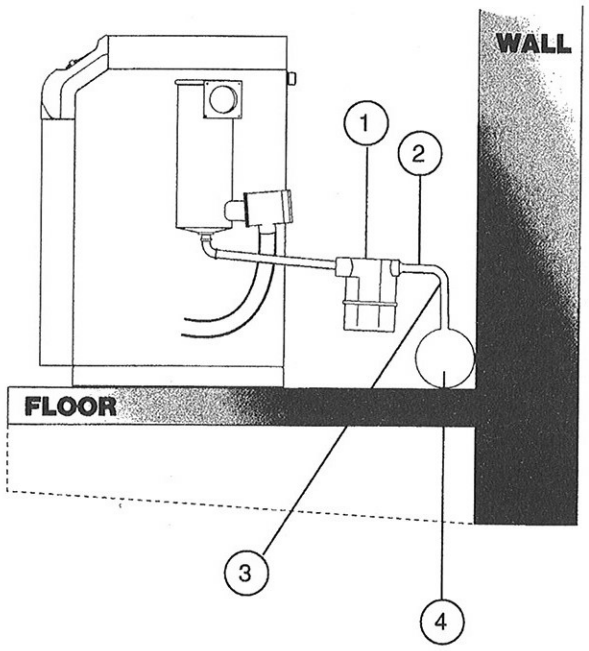
When connecting the condensate drain to the waste water drain, it is essential:

— to maintain a downwards slope towards the waste drain.

— to connect an accessible u-trap, allowing 80mm clearance below for cleaning.

Note: The maximum production of condensate is 1.5 L/h. This flow rate does not require any specific treatment.

Fig. 23. Condensate drain connection



1. Accesible siphon/u-trap
2. Pipe Ø 40mm
3. Elbow Ø 40mm
4. Waste water drain

11.7 Replace the electrical control panel and side panels in reverse order to the removal procedure of Section 5 and connect the electrical supply as described in Section 10.

12. Commissioning the Appliance

Ensure that no foreign matter is left in the system as this could cause damage to the appliance.

12.1 Check that the electrical supply to the appliance is switched off.

12.2 When commissioning the appliance after initial installation follow the procedure from 12.3, otherwise remove the burner first as described in Section 14.3.

12.3 Prepare the heating system

1. After initial installation and checking for leaks, as previously described, drain down the system sufficiently to add a flushing agent. Flush the system in accordance with BS 7593:1992.

2. Refill the system.

12.4 Check the Burner

1. Check that the nozzle and electrode settings are correct for the relevant burner. (See Fig. 25).

2. Check that the nozzle lies central with the combustion head hole.

3. Check for any visible defects.

12.5 Replace the burner

1. Connect the flexible oil supply hose and tighten sufficiently to form a good seal. Where a double pipe system is being used connect the oil return flexible hose to the return pipe fitting.

2. Insert the burner into the burner mounting flange and tighten the locking nut using a 13mm spanner.

Note: It is important that a good seal is made between the burner and the boiler to prevent the escape of the flue gases from the combustion chamber.

12.6 Check the installation

1. Check that the appliance is correctly wired as described in Section 10.

2. Check that the baffles are correctly located.

3. Check that the combustion product high limit thermostat phial is correctly located in the thermostat pocket positioned in the top front of the condensing heat exchanger.

4. Check that the water high limit thermostat is located in the pocket on the main heat exchanger.

5. Check that all of the air-ways to the burner are clear of any obstruction.

12.7 Fit a pressure gauge and manifold to the burner pump at the point indicated in Fig. 25.

12.8 Turn on the electricity to the appliance.

12.9 Bleed the burner

Single pipe systems only

Release the fuel bleed port on the manifold and place a suitable receptacle beneath. Turn on the boiler thermostat. Set the programmer to **heating and hot water** and allow the burner to run through to lockout. Wait two minutes and reset the burner control box. Repeat the procedure at least three times or until a steady stream of oil, without air, is exhausted from the bleed port. Re-lock the bleed port.

Two Pipe System

A two pipe system will automatically vent the air back to the oil tank. Turn on the boiler thermostat and allow the burner to run through to lockout. Wait two minutes and reset the burner control box. Repeat the procedure untill the burner fires and runs in a steady state. This may take several attempts depending on the oil pipe length and height.

12.10 Adjust the air shutter and pump pressure to the settings recommended in Table 2. After a pre-ignition period of approximately 15 seconds the burner should ignite. Flame sensing is carried out by means of a photocell mounted in the burner body. Should the boiler fail to establish a normal firing pattern (or should flame failure occur during running), the absence of a flame is sensed and the control box is monitored to a safe lock-out condition and the boiler is shut down. The lockout indicator light in the boiler control panel will illuminate indicating that the burner has gone to lockout. In this instance wait two minutes

and press the red lockout reset button mounted in the burner control box. Another start sequence is then initiated. Repeat the procedure until a flame is established.

Note: Persistent lockout when running indicates a fault and a Service Engineer should be consulted.

12.11 Run the boiler for approximately 3 minutes and switch off checking that there is no after-spurting from the nozzle. This can be detected by oil saturation on the blast tube. If after-spurting occurs remove the burner from the boiler, unscrew the nozzle, and while holding the burner in a vertical position, fill the nozzle holder with oil. Refit the burner and continue to run the boiler for three minute periods until after-spurting stops.

Note: Use of a "T" piece pressure gauge manifold will increase the oil line volume and hence increase the degree of after-spurting.

12.12 Run the boiler for a further 15 minute period and then finally fine tune the air shutter setting to give the CO_2 level specified in Tables 2 to 9. During this period some smoke will be emitted due to the burning of the organic binder in the base insulation board. Smoke readings will therefore be inaccurate at this point.

Note: A combustion product sampling point is located on the front of the condensing heat exchanger (see Fig. 24).

12.13 Check that the smoke reading is in the range 0-1. If this cannot be achieved then check that the burner head is set correctly and the nozzle is in good condition.

12.14 Check that the flue temperature does not exceed the value specified in Table 2. If this is the case then check that the baffles are correctly located. If the baffles are correctly located then reduce the pump pressure since nozzle variations of up to + or – 15% may occur.

12.15 Remove the oil pressure gauge and manifold and check all oil system joints for any signs of leakage.

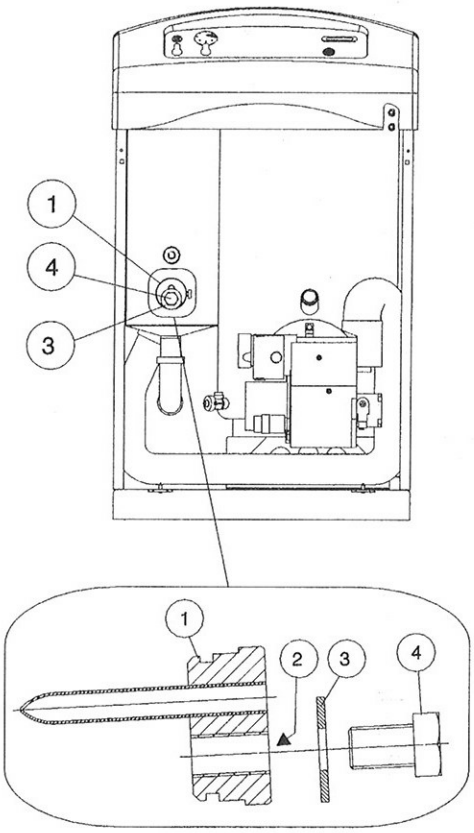
12.16 Allow the burner to run for a further five minutes and then recheck the CO_2 level and adjust the air setting if required. Check that the smoke number is in the range 0-1. Repeat the fine tuning procedure if found necessary.

12.17 Refit the cabinet top and front panels in the reverse order to that described in Section 5.

12.18 When the heating circuit has reached full operating temperature check the whole system for any leaks.

12.19 Add a suitable proprietary corrosion inhibitor such as Fernox or Sentinel. This will inhibit corrosion, protect the circulating pump and valves reducing the possibility of "kettling" noises resulting from deposits of scale and sludge in the boiler. Refer to the product manufacturers instructions for further information.

Fig. 24. Secondary heat exchanger inspection ports



1. Inspection/cleaning port
2. Combustion test point
3. Washer
4. Test point screw

13. Instructions to the User

13.1 Hand the users instructions to the user or purchaser for retention and instruct them in the efficient and safe operation of the appliance and the heating/hot water system.

13.2 Advise the user or purchaser of the precautions necessary to prevent damage to the heating/hot water system and to the building in the event of the heating system remaining inoperative during frost conditions.

13.3 Finally advise the user or purchaser that for continued efficient and safe operation of the appliance it is important that adequate servicing is carried out by a qualified engineer at least once per year.

Worcester Heat Systems Limited will be pleased to discuss and offer a comprehensive maintenance contract.

13.4 Set the system controls to the users requirements.

14. Routine Cleaning and Inspection

14.1 The following should be carried out at least once per year to ensure efficient, trouble free operation.

1. Carry out a pre-service check noting any operational faults.
2. Check and clean the burner.
3. Check and clean the air intake tube and the air intake grille at the end of the terminal.
4. Check and clean the baffles.
5. Check and clean the heat exchanger surface.
6. Check the heat shield.
7. Check the combustion chamber base insulation board.
8. Check and clean the secondary heat exchanger and baffles.
9. Check that the flue system is unobstructed and clean as necessary.
10. If the appliance has been installed in a compartment check that the ventilation areas are clear.
11. Clean all oil filters.

Some of the servicing points are covered more fully in the following instructions:-

14.2 Pre-Service Check

1. Remove the cabinet front and top panels as described in section 5 .
2. Operate the appliance and system, noting any faults which may need to be corrected during the service.

14.3 Cleaning the Burner

IMPORTANT: Disconnect the electrical supply at the mains before commencing any servicing. Turn off the oil at the service cock.

1. Remove the burner.

(a) Isolate the oil supply.

(b) Remove the 13mm nut at the top of the burner and pull the burner out, taking care not to put any tension on the electrical cable.

2. Clean the fan impeller using the following procedure:

(a) Remove the air adjustment cover.

(b) Separate the main body of the burner from the burner front by removing the M6 allen screw (located beneath the air adjustment screw), using a 5mm allen key.

(c) Note the position of the air damper adjustment and check the air damper moves freely.

(d) Check the air path to the burner head is clear.

(e) Clean both sides of the fan impeller and remove any debris from the burner housing.

(f) Check the impeller rotates freely.

(g) Re-assemble the components.

Fig. 25. Electro Oil Bentone Sterling Burner.

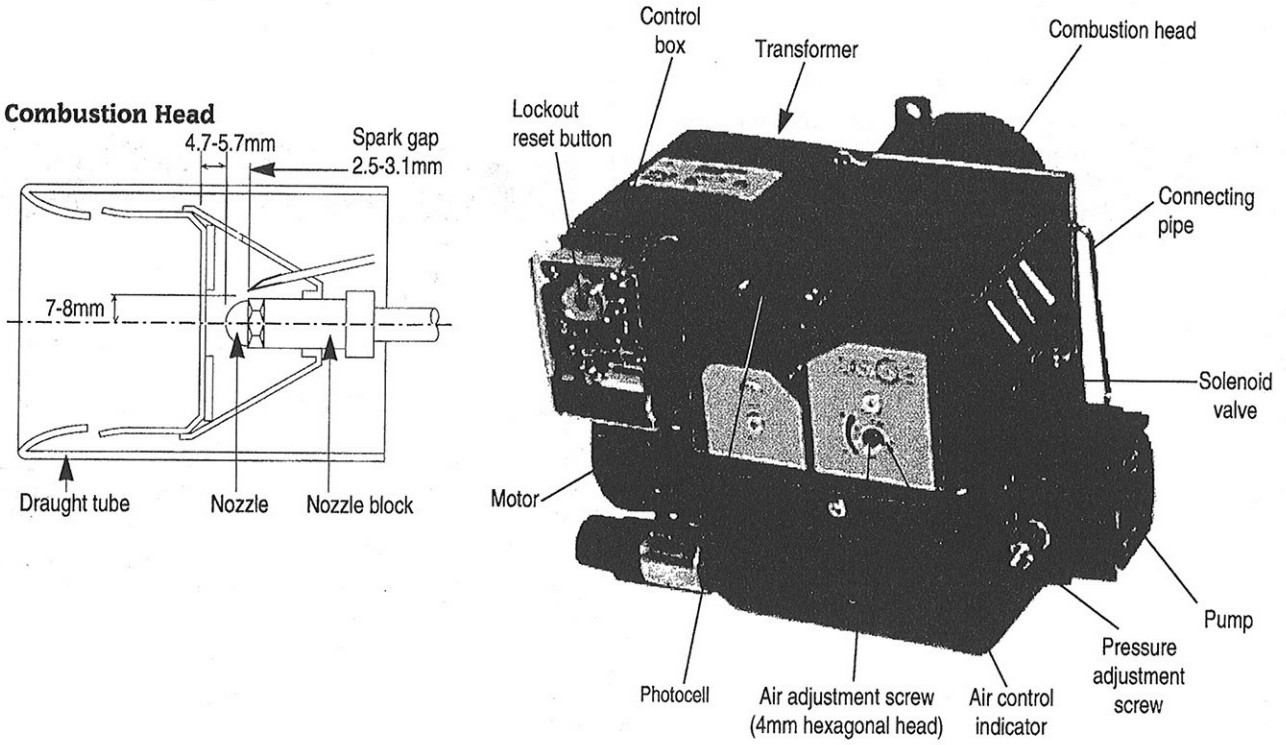
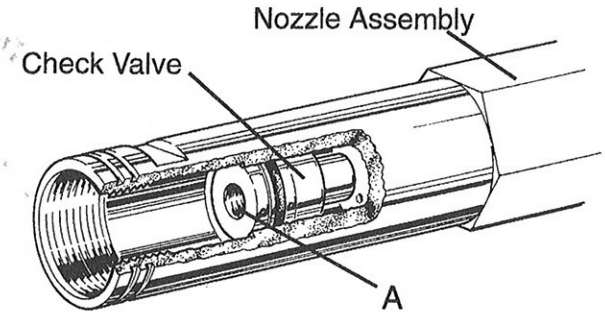


Fig. 26. Mechanical Shut-off Valve.



4. Inspection of Mechanical Shut-off Valve. (See Fig. 27)

a) Remove the nozzle.

b) Fasten an M5 screw, with a minimum length of 30mm, into the threaded hole (A) and pull the screw to withdraw the check valve.

c) Check that the nozzle holder is clear of any debris and clean if necessary.

d) Check that the 3 holes in the check valve are clear of any debris. Discard the check valve if the holes cannot be cleared or if the unit is defective and replace with a new one.

e) Replace in the reverse order.

5. It is strongly recommended that the oil atomising nozzle is replaced at each service.

6. Check and reset the electrodes, where necessary, as shown in Fig. 25.

7. Replace the combustion head and check that the nozzle lies central to the combustion head and the head settings are as shown in Fig. 25.

8. Withdraw the photocell from its housing and clean.

9. Remove and clean the oil pump internal filter using kerosene or white spirit. The internal filter is accessed by removing the oil pump cover on the Danfoss BFP 11 and Suntec AS47C as indicated in Fig. 16.

10. It is recommended that the standard flexible oil line is replaced at each yearly service to prevent the possibility of a leak due to ageing.

11. Re-assemble the burner components.

12. Check the sponge O-ring seal located around the combustion head and replace if necessary. It is imperative that this seal is in good condition since failure will cause the flue gases to escape.

14.4 Remove the paper element from the external oil filter and replace. If the filter contains a washable element then thoroughly clean in Kerosene or white spirit and re-assemble into the filter.

14.5 Clean the air duct tube.

1. Remove the air duct from the burner.

2. Shine a light down the air duct and inspect for any sign of debris and clean where necessary using a flexible hose connected to a vacuum cleaner. A short length of garden hose would be suitable for this purpose.

3. Reconnect the air duct tube.

14.6 Clean the Boiler (See Fig. 27)

1. Remove the boiler top access plate (3) by releasing the bolts (2) with a 6mm Allen key and check the fibreglass rope seal. Replace the seal if necessary.

2. Remove the flue deflector (4).

3. Remove the main baffle assembly (5), clean and check its condition. Replace if considered to be badly corroded.

4. Thoroughly clean all of the heat exchanger surfaces using a stiff wire brush and vacuum clean all loose debris from the combustion chamber. Take care not to damage the base insulation!

5. Check the heat shield.

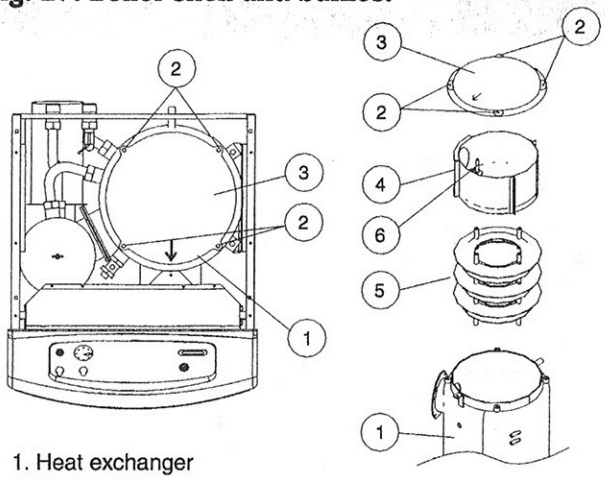
6. Check the condition of the combustion chamber base insulation and replace if there is any sign of significant damage.

7. Check and clean the flue.

8. Reassemble all parts and be sure:

- not to reverse them
- to position the flue deflector with its locating screw towards the front of the boiler.
- to position the cast iron plate against marker opposite the locating screw.

Fig. 27. Boiler shell and baffles.



1. Heat exchanger
2. Cover screws
3. Cover
4. Flue deflector
5. Baffle assembly
6. Locator pin

14.7 Secondary Heat Exchanger. (See Fig. 28)

Clean the secondary heat exchanger.

Remove the wing nut (4) and heat exchanger cover (5).

Remove each baffle (8), clean and check condition. Use the brush provided to clean each tube in the heat exchanger (7).

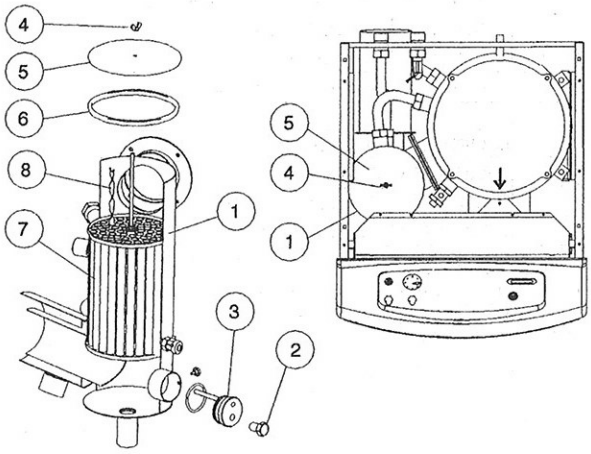
Wash any debris away by flushing with water.

Remove inspection plug (3) at base and clean as necessary.

Replace plug.

Replace baffles and cover, securing with wing nut, ensuring a good seal is made.

Fig. 28. Secondary heat exchanger.



1. Secondary heat exchanger
2. Combustion products screw
3. Inspection port
4. Wing nut
5. Cover
6. Seal
7. Stainless steel tubes
8. Baffles

14.8 Fire Valve.

Check that a fire valve is fitted to the incoming oil line with the body located outside the premises and the detection element located within the appliance case. Test the operation of the fire valve to ensure that the mechanism operates and that the oil supply is completely isolated.

14.9 Recommission the Burner.

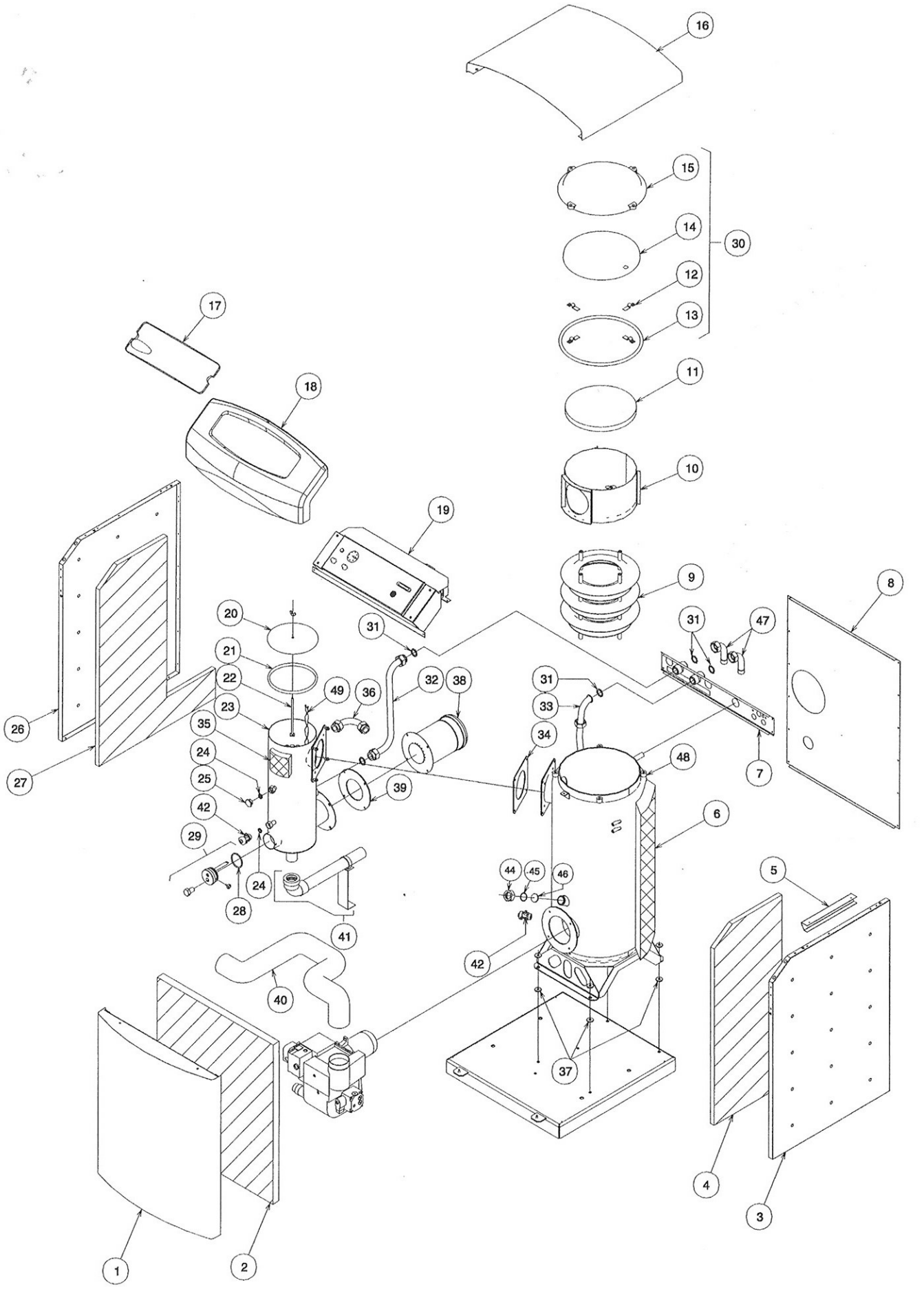
1. Connect the flexible oil supply hose to the isolating valve and tighten sufficently to form a good seal. Where a double pipe system is being used connect the oil return flexible hose to the return pipe fitting.
2. Insert the burner into the burner mounting flange. Push the burner firmly forward to compress the gasket and tighten the locking nut with a 13mm spanner.

Note: It is important that a good seal is made between the burner and the boiler to prevent the escape of the gases from the combustion chamber.

3. Turn on the oil supply at the service cock.
4. Recommission the burner as described in Section 12.

15. Short Parts List

Key No.	Item Ref.	Part	Manufacturer's Reference	WHS Part No.
16	BOILER	Top Panel	Y 72.26519	8 716 103 275 0
1	BOILER	Front Panel	Y 72.26518	8 716 103 260 0
26	BOILER	Left Hand Side Panel	Y 72.26665	8 716 103 285 0
3	BOILER	Right Hand Side Panel	Y 72.26664	8 716 103 262 0
17	BOILER	Facia Cover	H 20.26493	8 716 103 276 0
18	BOILER	Facia Surround	H 20.26489	8 716 103 277 0
9	BOILER	Baffle Assembly	V 72.08493	8 716 103 268 0
10	BOILER	Flue Deflector	V 72.08531	8 716 103 269 0
11	BOILER	Flue Deflector Insulation	F 30.11048	8 716 103 270 0
12	BOILER	Insulation Retaining Bracket	V 72.28378	8 716 103 271 0
13	BOILER	Cover Plate Insulation	V 70.09239	8 716 103 272 0
14	BOILER	Ceramic Fibre Insulation	F 20.28379	8 716 103 273 0
15	BOILER	Boiler Shell Cover Plate	H 00.28364	8 716 103 274 0
20	BOILER	Secondary Heat Exchanger Cover Plate	V 72.08509	8 716 103 279 0
21	BOILER	Secondary Heat Exchanger Cover Seal	V 72.09520	8 716 103 280 0
22	BOILER	Secondary Heat Exchanger Cover Fixing Screw	V 72.26826	8 716 103 281 0
23	BOILER	Secondary Heat Exchanger Assembly	V 72.30129	8 716 103 282 0
24	BOILER	Seal AMF34 D. 18,6 x 12 2mm Depth	E 20.06892	8 716 103 283 0
25	BOILER	Brass Cap M1/2	K 20.13910	8 716 103 284 0
28	BOILER	Nitrile 'O' Ring D 50 x 4	E 00.08776	8 716 103 287 0
29	BOILER	Secondary Heat Exchanger Cleaning cap Assembly	V 72.28241	8 716 103 288 0
31	BOILER	Fibre Washer AMF34D 30x21x3	E 20.03889	8 716 103 290 0
32	BOILER	Heating Return Pipe	U 72.26515	8 716 103 291 0
33	BOILER	Heating Flow Pipe	U 72.26517	8 716 103 292 0
34	BOILER	Secondary Heat Exchanger Flange Seal	E 20.26827	8 716 103 293 0
39	BOILER	Flue Seal D. 162x85x4 Silicone	E 20.28092	8 716 103 298 0
40	BOILER	Air Duct Tube	U 65.29493	8 716 103 299 0
41	BOILER	Condensate Discharge Assembly	V 72.26687	8 716 103 300 0
42	BOILER	Drain Valve with Cap M1/2 - 3/4	K 50.11590	8 716 103 301 0
47	BOILER	Flow /Return Elbow 22mm	U 72.30208	8 716 103 306 0
49	BOILER	Secondary Heat Exchanger Baffle	V 72.12096	8 716 103 308 0
*	BOILER	Flue Seal Viton D. 80	E 20.30012	8 716 103 309 0
*	BOILER	Nylon Stud (Male)	T 25.07874	8 716 103 310 0
*	BOILER	Nylon Stud (Female)	T 25.07875	8 716 103 311 0
2	ELECTRICAL BOX	Cable Grommet	C 91.03071	8 716 103 313 0
3	ELECTRICAL BOX	Cable Clamp	C 91.12561	8 716 103 314 0
4	ELECTRICAL BOX	Terminal Block 1014H SP 2311	C 19.24474	8 716 103 315 0
5	ELECTRICAL BOX	Control Box Cover	Y 72.26696	8 716 103 316 0
6	ELECTRICAL BOX	Thermometer 69x14 LG CAPIL. 1500mm	L 60.01135	8 716 103 317 0
7	ELECTRICAL BOX	Control Thermostat JAEGER 20/80 CAP1, 5 M TUA 4C	L 71.04202	8 716 103 318 0
8	ELECTRICAL BOX	Control Knob	H 20.18800	8 716 103 319 0
9	ELECTRICAL BOX	Control Knob Stop Plate Ref: 108 774.02 JAEGER PL: T 40.	T 40.18871	8 716 103 320 0
10	ELECTRICAL BOX	Neon Indicator Red 230V	C 90.03244	8 716 103 321 0
11	ELECTRICAL BOX	Facia Panel + Label	W 72.30122	8 716 103 322 0
12	ELECTRICAL BOX	Flue Safety Thermostat - 110 CAP 1,5M TG400	L 71.11583	8 716 103 323 0
13	ELECTRICAL BOX	High Limit Thermostat - 120 CAP 1,5M TG400	L 71.11584	8 716 103 324 0
14	ELECTRICAL BOX	On/Off Switch and Green Light	C 20.24904	8 716 103 325 0
1	BURNER	Burner - Elecro Oil/Bentone Sterling 40A	T108 (PL10-516-2)	8 716 103 406 0
2	BURNER	Blast Tube - PL 10-5-16-8 x 80mm		8716 103 407 0
3	BURNER	Nozzle - danfoss 0.45 80 DEG EH		8 716 103 408 0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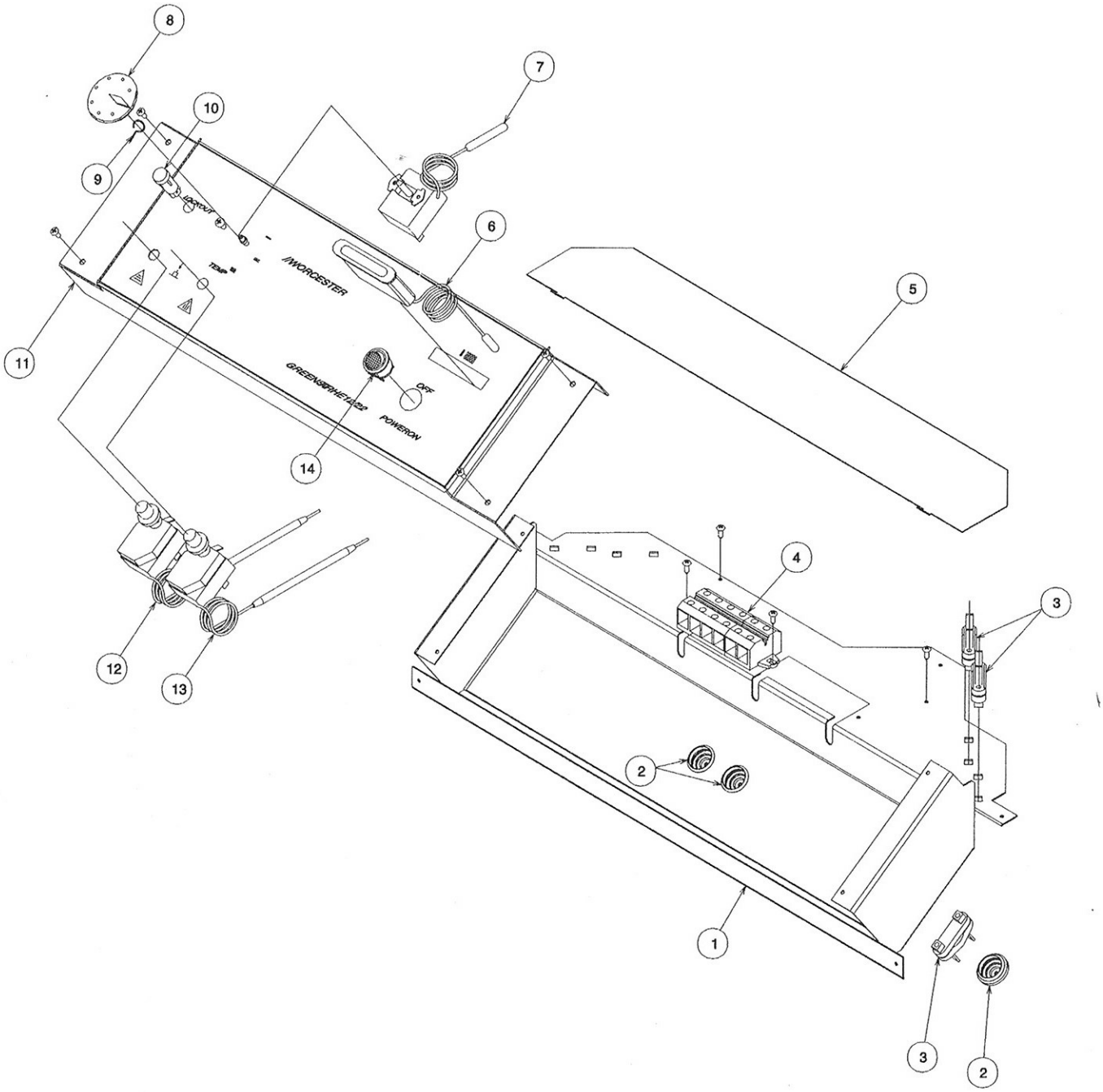
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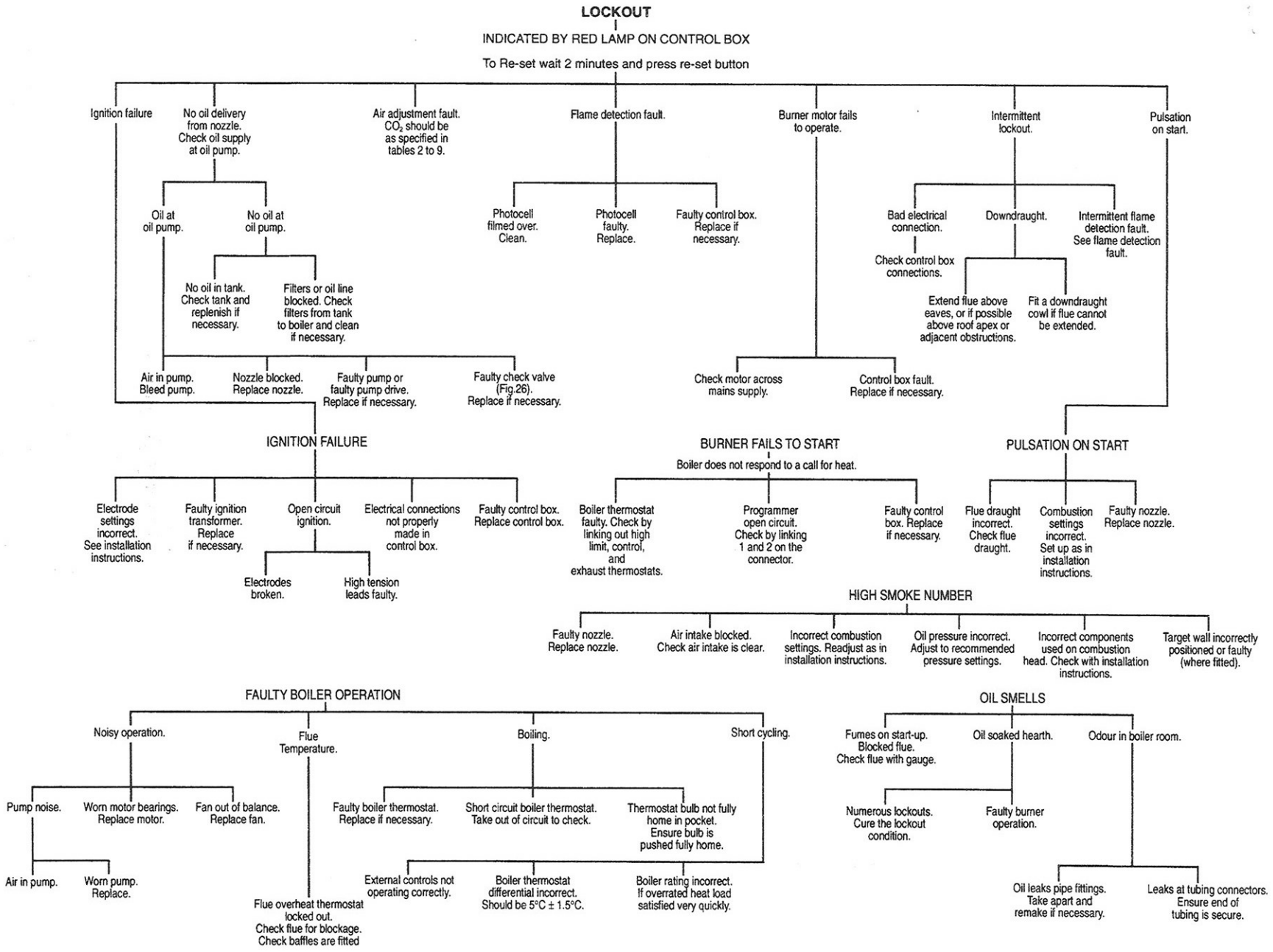
LOCKOUT
INDICATED BY RED LAMP ON CONTROL BOX
To Re-set wait 2 minutes and press re-set button
Ignition failure
No oil delivery from nozzle. Check oil supply at oil pump.
Air adjustment fault. CO_2 should be as specified in tables 2 to 9.
Flame detection fault.
Burner motor fails to operate.
Intermittent lockout.
Pulsation on start.
Oil at oil pump.
No oil at oil pump.
No oil in tank. Check tank and replenish if necessary.
Filters or oil line blocked. Check filters from tank to boiler and clean if necessary.
Photocell filmed over. Clean.
Photocell faulty. Replace.
Faulty control box. Replace if necessary.
Bad electrical connection.
Check control box connections.
Downdraught.
Extend flue above eaves, or if possible above roof apex or adjacent obstructions.
Fit a downdraught cowl if flue cannot be extended.
Intermittent flame detection fault. See flame detection fault.
Air in pump. Bleed pump.
Nozzle blocked. Replace nozzle.
Faulty pump or faulty pump drive. Replace if necessary.
Faulty check valve (Fig.26). Replace if necessary.
Check motor across mains supply.
Control box fault. Replace if necessary.
IGNITION FAILURE
Electrode settings incorrect. See installation instructions.
Faulty ignition transformer. Replace if necessary.
Open circuit ignition.
Electrical connections not properly made in control box.
Faulty control box. Replace control box.
Electrodes broken.
High tension leads faulty.
BURNER FAILS TO START
Boiler does not respond to a call for heat.
Boiler thermostat faulty. Check by linking out high limit, control, and exhaust thermostats.
Programmer open circuit. Check by linking 1 and 2 on the connector.
Faulty control box. Replace if necessary.
PULSATION ON START
Flue draught incorrect. Check flue draught.
Combustion settings incorrect. Set up as in installation instructions.
Faulty nozzle. Replace nozzle.
HIGH SMOKE NUMBER
Faulty nozzle. Replace nozzle.
Air intake blocked. Check air intake is clear.
Incorrect combustion settings. Readjust as in installation instructions.
Oil pressure incorrect. Adjust to recommended pressure settings.
Incorrect components used on combustion head. Check with installation instructions.
Target wall incorrectly positioned or faulty (where fitted).
FAULTY BOILER OPERATION
Noisy operation.
Flue Temperature.
Boiling.
Short cycling.
Pump noise.
Worn motor bearings. Replace motor.
Fan out of balance. Replace fan.
Air in pump.
Worn pump. Replace.
Flue overheat thermostat locked out. Check flue for blockage. Check baffles are fitted
Faulty boiler thermostat. Replace if necessary.
Short circuit boiler thermostat. Take out of circuit to check.
Thermostat bulb not fully home in pocket. Ensure bulb is pushed fully home.
External controls not operating correctly.
Boiler thermostat differential incorrect. Should be 5°C ± 1.5°C.
Boiler rating incorrect. If overrated heat load satisfied very quickly.
OIL SMELLS
Fumes on start-up. Blocked flue. Check flue with gauge.
Oil soaked hearth.
Odour in boiler room.
Numerous lockouts. Cure the lockout condition.
Faulty burner operation.
Oil leaks pipe fittings. Take apart and remake if necessary.
Leaks at tubing connectors. Ensure end of tubing is secure.

WORCESTER
Bosch Group

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